Safety limitations. The safety limitations for BCMA are not specific to oncology but include the requirement for nurses to override medications for verbal orders and the requirement for pharmacy to change the medication schedule to avoid wrong schedule alerts.

Deployment in Outpatient Oncology Infusion Centers

The overall success of this approach has prompted us to deploy the same system infrastructure to the outpatient chemotherapy infusion centers. This will provide longitudinal views of chemotherapy drug administration events that span both the inpatient and outpatient settings, as well as multiple patient encounters. A unique challenge for deployment in the outpatient infusion center includes the need to record the stop time for billing purposes. The system is being configured to enable recording of multiple start and stop times. In addition, the “too early” or “too late” alerts generated by the system will need to be modified because of the complex and unpredictable scheduling requirements of the outpatient setting.

We believe that electronic medication administration provides an auditable system for safe chemotherapy administration and compliance with documentation guidelines. The resultant tighter coupling of pharmacy and nursing workflows has several advantages and disadvantages, but overall, the improvements outweigh the limitations.

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Author Contributions

Conception and design: Mia A. Levy, Dario A. Giuse, Carol Eck, Gwen Holder, Julia Cartwright, Nancy K. Rudge

Provision of study materials or patients: Gwen Holder

Collection and assembly of data: Carol Eck, Gwen Holder

Data analysis and interpretation: Giles Lippard

Manuscript writing: Mia A. Levy, Dario A. Giuse, Carol Eck, Gwen Holder, Giles Lippard, Julia Cartwright, Nancy K. Rudge

Final approval of manuscript: Mia A. Levy, Dario A. Giuse, Carol Eck, Gwen Holder, Giles Lippard, Julia Cartwright, Nancy K. Rudge

Corresponding author: Mia A. Levy, MD, PhD, Vanderbilt Ingram Cancer Center, 2220 Pierce Avenue, 691 Preston Research Building, Nashville, TN 37232-6838; e-mail: mia.levy@vanderbilt.edu

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Patient-Physician E-Mail Communication: The Kaiser Permanente Experience

By David Baer, MD

Kaiser Permanente Oakland, Oakland, CA

Abstract

Kaiser Permanente (KP) is a not-for profit health care organization that provides care for approximately 8.7 million members in nine states and the District of Columbia. In 2004, it began implementation of its current electronic health record (EHR), which by 2010, was in use in all KP regions, in both outpatient and inpatient settings. Over the same period, a suite of online services was also implemented. Among these services was a password-protected e-mail system (referred

to as secure messaging) that allowed physicians and patients to communicate electronically. Use of secure messaging has increased rapidly. By 2010, 64% of the 3.6 million KP members in northern California had signed up for online access. In 2010, the 7,000 physicians of Northern California KP received 5.8 million secure messages. Secure messaging has been associated with a decrease in office visits, an increase in measurable quality outcomes (at least in primary care), and excellent patient satisfaction.

A survey conducted in May 2010 by the Pew Internet and American Life Project found that 79% of adult Americans had access to the internet, and among these users, 91% sent and received e-mail, 72% purchased products on-line, 66% arranged travel plans, 58% accessed online banking, and 83% used the Internet to search for health or medical information.¹ According to a 2002 Harris Interactive poll, 90% of patients with Internet access would like to be able to consult their physician by e-mail.² However, physicians have been slow to adopt electronic communication with their patients. A survey of physicians in Florida found that in 2008 only 20% had ever used e-mail, and only 2.9% frequently used e-mail to communicate with patients.³ Barriers to the adoption of physician-patient electronic messaging include reimbursement disincentives, medical culture, licensing issues, and liability concerns.⁴ Guidelines for electronic communication with patients, developed by the American Medical Association,⁵ and by the American Medical Informatics Association,⁶ advise that physicians develop a patient-clinician agreement and consent form that should be discussed with and signed by each patient before engaging in electronic communication.

Kaiser Permanente (KP), founded in 1945, is a not-for profit health care organization, made up of the Kaiser Foundation Hospitals and the Kaiser Foundation Health Plan, that operates eight distinct administrative regions located in nine states and the District of Columbia. It provides care for approximately 8.7 million members, and owns and operates 35 medical centers and 431 medical offices. Health care is overseen by the approximately 14,000 salaried physicians who belong to eight autonomous but affiliated Permanente Medical Groups (one for each region). These Medical Groups, which are structured as for-profit professional corporations or partnerships, contract with Kaiser Foundation Health Plan on a capitated basis and, through long-standing agreements, partner with Kaiser Foundation Hospitals to manage the medical centers and offices where care is provided.

KP has long been an innovator in electronic health records (EHRs) and medical informatics,⁷ and in 2004 it began implementation of its current EHR, branded HealthConnect (KPHC), which is based on the widely used EHR marketed by the Epic Systems Co. (Verona, WI). By 2010, KPHC had been implemented in all eight KP regions, in both outpatient and inpatient settings.

An important component of KPHC is a suite of on-line services that can be directly accessed by health plan members. While the range of services available online is evolving and expanding, current functionality provides patients the ability to (1) view laboratory results, immunizations, appointments, and prescriptions; (2) make and cancel appointments or order prescription refills; (3) have proxy access to act on behalf of a child or other family member; (4) access online health and drug encyclopedias, health calculators, and interactive behavior modification programs that address topics such as weight loss and smoking cessation; (5) access information regarding benefits and insurance premiums; and, most notably, (6) communi-

cate with physicians using a password-protected, encrypted, Health Insurance Portability and Accountability Act–compliant e-mail system (secure messaging) that automatically incorporates the messages and physician replies into the patient's electronic record.

The initiation of secure messaging was met with a great deal of apprehension. How would it affect established work flows and the quality of care? Would it be accepted by patients? Busy physicians, who were not given the choice to opt out of using the system, expressed the fear that they would be overwhelmed by excessive numbers of electronic messages. How would they accept this new manner of interacting with patients?

Beginning in 2004, the KP Hawaii Region was the first region to fully implement KPHC. Patient-physician secure messaging became available in September 2005. Using a retrospective observational methodology, Chen et al⁸ found that between 2004 and 2007, in the Hawaii Region, the total number of office visits, adjusted by age and sex, decreased by 26.2%. This decrease, however, was more than offset by an increase in telephone encounters and secure messages, so that the total number of patient contacts increased by 8.3%. Internal data from member satisfaction surveys showed little change over the period.

Also during the 2005 to 2007 time period, Zhou et al⁹ investigated the experience of implementing KPHC in the KP Northwest Region. Using a retrospective cohort study of 4,686 registered KPHC online users, and a 3,201-subject subset of that group for whom they were able to identify controls matched for age, sex, selected chronic conditions, and primary care physician, they found that office visits to adult primary care physicians decreased 10.3% among online users versus 3.7% for controls ($P < .003$). Telephone encounters increased for both groups but by a smaller degree among online users: 16% versus 29% ($P < .01$). In a companion study, Serrato et al¹⁰ surveyed both patients and providers to assess their acceptance of secure messaging. Patients were highly satisfied with the secure messaging process, with 85% rating their satisfaction as 8 or 9 on a 9-point scale. Physicians, who were initially cautious about encouraging their patients to use secure messaging, found that patients generally used it appropriately and sought answers to clinically relevant questions.

An assessment of KPHC implementation in the KP Southern California Region between February 2005 and December 2008 examined secure message usage and quality outcomes.¹¹ The study examined glucose, hypertension, and low-density lipoprotein control as well as screening for nephropathy and retinopathy among diabetic patients. In logistic regression modeling, the use of patient-physician secure messaging was an independent predictor of improved performance on quality outcomes ($P < .0001$ for each outcome). To verify these observations, a separate analysis was conducted using a matched-control comparison. Secure message users were matched by baseline status on the quality measures, age, sex, and primary care provider. For each case-control pair, the rate at which quality outcomes were met was assessed 2 months after the secure message user began electronically communicating with

his or her physician. Again, secure message users demonstrated improved outcomes when compared with nonusers. For four of the quality measures, a dose-response effect could be observed in which users who had multiple communications with their physician experienced even better outcomes.

Over time, both patients and physicians have become increasingly comfortable with the use of secure messaging, and both have discovered the convenience and effectiveness of incorporating it into their workflows. As of December 2010, in the KP Northern California Region, 64% of all eligible health plan members had signed up for online access. According to Silvestre et al,¹² on-line users are 60% female and 40% male. The median age is 48 but ranges from 13 (the minimum age at which members can register) to 95, dispelling the prejudice that internet users are primarily the young (Figure 1). In 2010, the 7,000 physicians of the Northern California Region received 5.8 million secure messages from the 3.6 million Northern California Region members of KP.

As might be expected, the use of this technology varies substantially among different specialties and among different individual physicians. Although a few practices have experimented with using nonphysician personnel to screen messages, the vast majority of communications have been directly handled by physicians. It would be fair to say that despite the rapid adoption of secure messaging by patients and physicians, the use of this tool, and appreciation of its potential, are continuing to evolve.

A great deal of effort went into making the secure messaging initiative a success. Secure messaging was promoted enthusiastically to both patients and physicians. Before it was implemented, physicians were given specific communication training regarding the use of secure messages. The software allows users to easily embed lab results, prewritten patient information handouts, and a glossary of text templates into reply messages. The wealth of patient resources and patients' access to their own health care data through the KP Web site undoubtedly contributed to the rapid adoption of secure messaging by patients.

There are no KP assessments that have focused on secure messaging specifically in medical oncology practices, but there would likely be a general consensus that the observations described above apply equally well in the oncology setting. In fact, the ability to ask questions, seek clarification, report on adverse effects, inquire about test results, or communicate a variety of concerns with secure messaging is highly valued by patients who are engaged in intensive, complicated treatment regimens involving multiple specialties. Secure messaging can allow health issues to be

Figure 1. Age distribution of Kaiser Permanente Web site users, April 2011.

closely monitored without the inconveniences of traffic, parking, insurance copayments, or lost days at work. It provides patients with written advice that might be forgotten or misunderstood if communicated verbally and avoids the annoyance of "telephone tag."

At a time when 66% of American adults have broadband Internet access in their homes,¹³ and when industries as diverse as air travel, banking, retail sales, and pizza delivery have been revolutionized by the improved service and streamlined cost structures associated with Internet usage, the American health care industry stands out in its failure to capitalize on the efficiencies, improvements in service, and quality gains that can be achieved with electronic communication and computerized record keeping. Despite the many barriers that stand in the way, the KP experience should offer encouragement and reassurance to those who seek to break down those barriers and bring this aspect of American health care delivery into the 21st century. Though potentially intimidating, the American Medical Association and American Medical Informatics Association guidelines provide excellent advice to those seeking to incorporate physician-patient e-mail communication into their practices.

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Corresponding author: David Baer, MD, Chief, Adult Hematology-Oncology, Kaiser Permanente, 280 W MacArthur Blvd, Oakland, CA 94611; e-mail: david.baer@kp.org.

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Outcomes of Computerized Physician Order Entry in an Electronic Health Record After Implementation in an Outpatient Oncology Setting

By Cara A. Harshberger, PharmD, Abigail J. Harper, PharmD, George W. Carro, MS, Wayne E. Spath, BS, Wendy C. Hui, PharmD, Jessica M. Lawton, PharmD, and Bruce E. Brockstein, MD

College of Health Sciences, School of Pharmacy, University of Wyoming, Laramie, WY; Kellogg Cancer Center Pharmacy; Department of Medicine, Division of Hematology-Oncology, NorthShore University HealthSystem, Evanston; Pritzker School of Medicine, University of Chicago, Chicago, IL

Abstract

Purpose: Computerized physician order entry (CPOE) in electronic health records (EHR) has been recognized as an important tool in optimal health care provision that can reduce errors and improve safety. The objective of this study is to describe documentation completeness and user satisfaction of medical charts before and after implementation of an outpatient oncology EHR/CPOE system in a hospital-based outpatient cancer center within three treatment sites.

Methods: This study is a retrospective chart review of 90 patients who received one of the following regimens between 1999 and 2006: FOLFOX, AC, carboplatin + paclitaxel, ABVD, cisplatin + etoposide, R-CHOP, and clinical trials. Documentation completeness scores were assigned to each chart based on the number of documented data points found out of the total data points assessed. EHR/CPOE documentation complete-

ness was compared with completeness of paper charts orders of the same regimens. A user satisfaction survey of the paper chart and EHR/CPOE system was conducted among the physicians, nurses, and pharmacists who worked with both systems.

Results: The mean percentage of identified data points successfully found in the EHR/CPOE charts was 93% versus 67% in the paper charts ($P < .001$). Regimen complexity did not alter the number of data points found. The survey response rate was 64%, and the results showed that satisfaction was statistically significant in favor of the EHR/CPOE system.

Conclusion: Using EHR/CPOE systems improves completeness of medical record and chemotherapy order documentation and improves user satisfaction with the medical record system. EHR/CPOE requires constant vigilance and maintenance to optimize patient safety.

Introduction

In the high-risk setting of oncology, medication error prevention is a top priority, but despite heightened focus, chemotherapy errors still occur.¹ Computerized physician order entry (CPOE) has been recognized as an important tool in optimal health care provision that can reduce medication errors and improve patient safety.^{2,3} By incorporating a CPOE program with clinical decision support into an electronic health record (EHR), the health care team can effectively and safely provide quality patient care. CPOE systems designed for the outpatient oncology setting have only recently become available and widely used. The relative inexperience with ambulatory oncology CPOE has resulted in a knowledge deficit concerning their impact on patient care.

The reluctance to adopt CPOE is a result of the many challenges associated with chemotherapy ordering in the outpatient oncology setting. A combination of high toxicity profiles and narrow therapeutic indexes for chemotherapy medications

makes tolerance for system failures in the oncology setting extremely low. In addition, chemotherapy regimens are complex, with varying doses and schedules. The outpatient oncology setting also has a large proportion of patients on clinical trial protocols that use highly complex monitoring parameters and dosing schemes. Furthermore, experience with chemotherapy medication ordering with inpatient-based CPOE systems has revealed that medication errors still occur; therefore, pharmacy and nursing review of orders is still a critical component in the prevention of medication errors.^{1,4} Documentation completeness is an important factor in error prevention because omission of pertinent information in the medication order or patient's chart has been identified as a potential source of medication errors.^{1,5}

To ensure the safety of oncology patients, Kellogg Cancer Center (KCC; Evanston, IL) is involved in continuous assessment and improvement of the EHR/CPOE system. The objectives of this study, conducted a year after CPOE implementation, were to compare the completeness of chemotherapy documentation in the